

middle of the anterior third of the tongue. Head longer than broad, moderately depressed; snout obtusely pointed, strongly projecting beyond the mouth, as long as the eye; canthus rostralis sharp; loreal region feebly oblique, deeply concave; nostril a little nearer the tip of the snout than the eye; interorbital space as broad as or a little broader than the upper eyelid; tympanum moderately distinct, not quite $\frac{1}{3}$ the diameter of the eye. Fingers rather slender, the tips dilated into very large discs which are broader than long; first finger longer than the second; subarticular tubercles small, feebly prominent. Toes rather short, the fourth not much longer than the fifth, with discs similar to those of the fingers but smaller, fully webbed, the web feebly notched and involving the base of the discs; no tarsal fold; inner metatarsal tubercle oval, flat, $\frac{1}{3}$ the length of the inner toe; no outer tubercle. Tibio-tarsal articulation reaching between the eye and the nostril; tibia 4 to $4\frac{1}{2}$ times as long as broad, twice, or slightly less than twice, in length from snout to vent, shorter than the fore limb, longer than the foot. Skin feebly granulate above, with flat glandules on the sides, of belly smooth or feebly granulate. Dark brown above and on the sides, including the upper lip, with a few very indistinct lighter vermicular markings on the head and back; limbs without or with rather ill-defined dark cross-bands; hinder side of thighs dark brown, with small yellow spots or vermicular markings; web between the toes blackish; lower parts white, throat brown or spotted with brown.

From snout to vent 42 mm.

This species is proposed for two female specimens, the larger from Mt. Kina Balu, North Borneo, altitude 4200 feet, received from Dr. R. Hanitsch in 1899, the smaller from Mt. Batu Song, Sarawak, 1000 feet, received from Dr. C. Hose in 1892.

XLVI.—*Further Notes on some External Characters of the Bears (Ursidæ).* By R. I. Pocock, F.R.S.

Introduction.

In 1914 (Proc. Zool. Soc. pp. 929-941) I described the feet and rhinaria of certain species of Ursidæ, and on the strength of the characters observed admitted the following genera of this family: *Melursus* for *ursinus*, *Helarctos* for *malayanus*, *Tremarctos* for *thibetanus* and *ornatus*, *Ursus* for *arctos*, *horribilis*, *americanus*, and their allies, and *Thalarctos* for

maritimus. The material examined consisted of a newly born cub of *Thalarctos maritimus* and of *Ursus arctos* and adult examples of *Melursus ursinus*, *Tremarctos thibetanus*, and of *Ursus americanus*, the conclusions regarding *Helarctos malayanus* being derived from an inspection of living specimens and dried skins. Since that date I have had the opportunity of examining in the Prosectorium of the Zoological Society fresh dead specimens of *Ursus horribilis* and of *Helarctos malayanus*, thus adding two species to my previous list, and also of *Melursus ursinus*, *Tremarctos thibetanus*, and of *Ursus americanus*, and an adult of *Ursus arctos* from North Russia, enabling me to confirm and extend my previous observations on these species. With regard to *Thalarctos* I can add nothing to what I previously stated.

The examples of *Ursus horribilis*, two females 25 and 27 years old respectively, from the Missouri Brakes, Montana, whence they were brought as cubs in 1890 by Mr. Ewen Cameron, cause me to modify considerably my conception of the genus *Ursus*. The feet, indeed, as explained below, differ so markedly from those of *Ursus americanus* that I am persuaded the two bears should be separated generically or subgenerically, unless other examples of *U. horribilis* show the characters to be variable, a conclusion not justified by the analogy of other Carnivora. In certain respects the feet of *Ursus arctos* bridge the interval between those of *U. horribilis* and *U. americanus*. But, curiously enough, *U. arctos* is in this character nearer *U. americanus* than *U. horribilis*, which was hardly to be expected from the external appearance of the species concerned.

It may be recalled that Gray long ago gave superspecific rank to these bears, applying the name *Danis* to *horribilis*, *Euarctos* to *americanus*, and reserving the name *Ursus* for *arctos* and its near allies. In the following pages the species are recorded under those names.

In 1917 (Ann. & Mag. Nat. Hist. ser. 8, vol. xx. p. 129) I severed *thibetanus* from *Tremarctos* as a distinct genus *Arcticonus*, based upon the cranial differences between the Asiatic and South American forms. Hence it follows that each of the well-marked types of living Bears takes generic or subgeneric instead of specific rank, a conclusion which many will deprecate, but which is more in accord with modern schismatic treatment than the older conception.

The existing genera and typical species of Ursidæ will therefore stand as follows:—*Thalarctos maritimus*, *Ursus arctos*, *Danis horribilis*, *Euarctos americanus*, *Arcticonus thibetanus*, *Helarctos malayanus*, *Melursus ursinus*, *Tremarctos ornatus*. Whether the various forms of *Ursus*, *Danis*,

Euarctos, *Arcticonus*, *Helarctos*, and *Tremarctos* should rank as species or subspecies is a matter about which there will probably be no unanimity for many years to come*.

In my previous paper upon the bears, only the rhinarium and feet were discussed. In the present instance I have added a few notes on the ears.

The Ears.

I have not examined the ears in *Thalarctos*, *Arcticonus*, *Melursus*, and *Tremarctos*, but, judging from their size in these genera, it may be assumed provisionally that they resemble the ears of *Ursus*, *Danis*, and *Euarctos*. Taking the ears of these three forms as typical, it may be said that in all bears, except *Helarctos*, the ears are expanded and flattened distally, with convex margin, and tubular proximally, the angular junction of the tragal and antitragal edges reaching nearly as high as the low-set supratragus, and the external meatus lying deep at the bottom of the tube. There is no trace of the bursa, an invariable feature in the Canidae and Felidae.

The supratragus (*plica principalis*) is a strong ridge overlapped anteriorly by the antero-internal ridge and provided towards its posterior end with a conspicuous knob-like thickening. The tragus and antitragus are small elevations separated by a shallow, narrow notch. The antero-external ridge above the tragus is weak but the antero-internal is strong and prominent where it overlaps the supratragus. The two posterior ridges are likewise moderately strong, the greater part of the external lying deep in the tubular hollow below the point of junction of the two rims externally †.

The ear of *Helarctos malayanus* (fig. 1, C) is much shorter and narrower and simpler than in the three above-mentioned species. The upper portion of the pinna is considerably less expanded and less rigid and its height from the supratragus to the summit is less than its total width, despite its narrowness. All the ridges are soft, not rigid, the tragus, the antitragus, and the anterior and posterior ridges are

* In 1896 Merriam (Proc. Biol. Soc. Wash. x. pp. 65-83) admitted *Euarctos*, comprising three species, as a subgenus of *Ursus*. The rest of the North American bears, excluding *Thalarctos*, he referred to *Ursus*, *sensu stricto*, recognising two species of the grizzly bear type and three of the brown bear type.

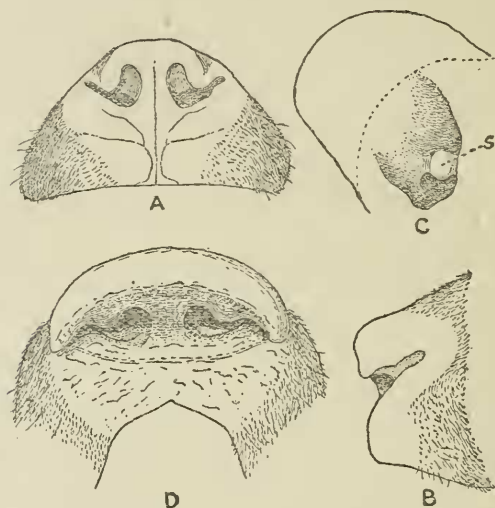
† The ears of *Melursus ursinus* and of *Helarctos malayanus* have been described by Boas (Die Ohrknorpel, etc., p. 136, 1912); but the figure of the ear of *M. ursinus* is not helpful from my present standpoint.

obsolete and the supratragus alone retains its normal size and shape.

The Rhinarium.

In profile view the rhinarium of *Danis horribilis* resembles that of *Euarctos americanus*, as figured by me in 1914, the septum of the nares visibly projecting beyond their lateral boundaries. From the anterior view also the rhinaria of the two species are much alike, except that in *D. horribilis* the

Fig. 1.



- A. Rhinarium and upper lip of *Helarctos malayanus* from the front.
 B. The same from the side.
 C. Right ear of *Helarctos malayanus*, flattened. *s.* supratragus; the dotted line indicates the line of attachment of the pinna to the head.
 D. Rhinarium and upper lip of *Melursus ursinus* from the front.

rhinarium is relatively a little wider, forming a disk about as wide as high, with the summit mesially depressed and the nares themselves more expanded laterally. Moreover, the median area of the upper lip below the rhinarium is scantily hairy. The rhinarium, however, is everywhere sharply circumscribed.

The rhinarium of the example of *Ursus arctos* generally resembles that of *Danis*, but the nostrils are a little smaller, the septum a little wider, and the infranarial portion less sharply defined from the tip towards the middle line, and the

lip itself showed hardly any vertical groove. These differences may be merely individual.

My figure of the rhinarium of *Helarctos malayanus*, published in 1914, was taken from a dried skin and very imperfect. In the fresh specimen examined, the rhinarium (fig. 1, A, B) from the front resembles in a general way that of *Danis horribilis*, *Euarctos americanus*, and *Arcticonus tibetanus*; but in profile view the lateral boundaries of the nares project beyond and conceal the septum as in *Melursus*. The skin round the disk is naked both dorsally, laterally, and inferiorly, and the rhinarium itself is nowhere sharply circumscribed, and the upper lip is more prominent and mobile than in ordinary bears, though less so than in *Melursus*.

The most noticeable characters in the rhinarium of *Melursus ursinus* are its great width as compared with its height, the transverse elongation of the nares, and the extent to which the nares are overlapped above and sideways by the upper rim and lateral lobes. The infranarial portion of the rhinarium is very shallow, indistinctly defined from the subjacent area of the upper lip which is to all intents and purposes naked, generally moist, and shows no trace of the median divisional line apparent in other bears, even in *Helarctos malayanus*. The structure of the rhinarium in *Melursus* suggests that the nostrils are capable of being closed by compression from above downwards (fig. 1, D).

The Feet.

My brief account of the feet of *Euarctos americanus* may be repeated and amplified.

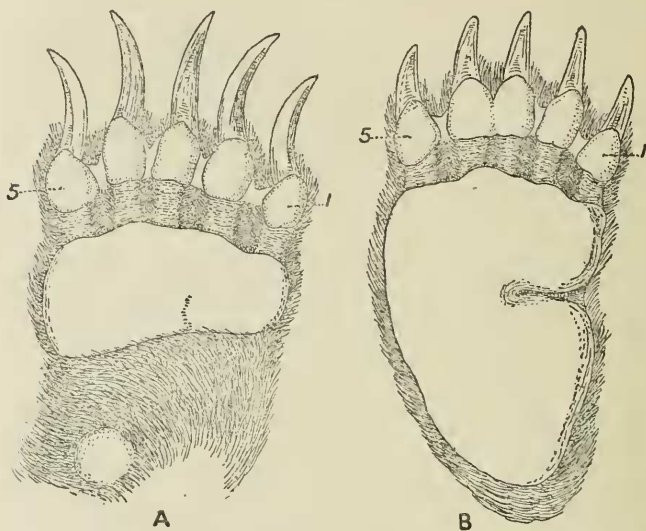
The digital pads of the fore foot are separated almost to their proximal ends, where they are united by a narrow strip of naked skin. They are susceptible of considerable divarication, expanding the paw distally. When in contact they form a relatively strongly curved line, the third and fourth toes projecting beyond the second and fifth, and the first lying considerably farther back and well behind the second. The area between the digital pads and the plantar pad is overgrown with hairs arranged in four patches on the interdigital webs, the middle line of each digit exhibiting a narrow hairless tract. The plantar pad appears to vary in shape and in its length with relation to its width*; but in all

* In my figure of the fore paw of a specimen from Newfoundland this pad is wider as compared with its length than in examples from Ontario subsequently examined; but whether this variation and the more distal placing of the pollical pad, as well as others observable in the hind foot of the Newfoundland specimen, are seasonal, local, individual, or due to inaccuracy of drawing, I am not in position to say.

cases the area behind it is overgrown with hairs from which the carpal pad arises, as an island, towards the outer or ulnar side of the wrist.

The hind foot, so far as the digital pads are concerned, agrees, broadly speaking, with the fore foot. The whole foot is actually longer and narrower than the fore foot; and the plantar pad is partially divided in two by a deep angular depression, covered with hair, which penetrates it on the inner or hallucal side. The part of the pad behind this hairy depression does not extend nearly to the tip of the heel, the extent of the heel which is covered with hair being

Fig. 2.



A. Right fore foot of *Danis horribilis* from below.
 B. Right hind foot of the same. 1, the first digit; 5, the fifth digit.
 (The hairs are everywhere cut short.)

almost equal to the length of the anterior half of the plantar pad along the middle line*.

In the fore foot of *Danis horribilis* (fig. 2, A) the digital pads are tightly tied together by naked integument extending approximately to the middle of their length, the integument

* At least in the Ontario specimens. In my figure of the hind foot of the Newfoundland specimen the heel appears to be much shorter; but the approximate equality in length between this foot and the fore foot of the same specimen convinces me that the precise length of the heel was disregarded in the illustration.

advancing a little further between the second, third, and fourth toes than between the first and second and the fourth and fifth. These pads, therefore, are susceptible of comparatively slight divarication. Moreover, the line of these pads is only lightly and tolerably evenly curved, the pad of first digit (pollex) lying alongside that of the second. It is noticeable that the strip of integument joining these two pads is a little wider than the others. In other respects the fore foot conforms to the type of *Euarctos americanus*, except that the hairy space between the digital and plantar pads is much shorter*.

The hind foot (fig. 2, B) with respect to the digital pads differs similarly from that of *Euarctos*, with the additional difference that these pads on the third and fourth digits are themselves immovably fused together along the proximal half of their juxtaposed edges and cannot be separated at all. The plantar pad covers the sole of the foot almost as far back as the tip of the heel, a relatively small portion of the latter being covered with hair; and the divisional depression passing inwards from the hallucal margin is both shorter and narrower than in *Euarctos*, and is, moreover, hairless.

Finally, in both the fore and hind feet the pads are much more coarsely papillate than in *Euarctos*.

In the analytical table of the external characters by which the genera of bears appeared to be distinguishable (P. Z. S. 1914, p. 940), I stated that the digital pads of the brown bear and of the grizzly bear are separated throughout their length. This was a double error, due to an examination of dried skins, to the necessarily superficial inspection of the feet of living examples, and, in the case of *U. arctos*, to my having only a newly-born cub, preserved in alcohol, in my hands.

In an adult example of *U. arctos*, from North Russia, the feet generally conform to those of *Danis horribilis*, but they differ in two particulars. The digital pads, although united by webbing to approximately the same extent, are susceptible of being more widely divaricated owing to the greater width of the web. This applies both to the fore and hind foot. Moreover, in *U. arctos* the pads of the third and fourth digits of the hind foot are not immovably fused together throughout the greater part of their length, but are quite free, although not to precisely the same extent as the third is from the second and the fourth from the fifth. The

* A feature possibly attributable to my inability to straighten the digits, owing to the previous immersion in alcohol of the feet of *D. horribilis*.

differences between the hind feet of *Danis* and *Ursus* may be seen by comparing my sketch of the right foot of the former with that of the latter, published by Boas in 1909 (Zool. Anz. xxxiv. p. 529). This figure shows the digits of *U. arctos* in their natural position and not separated to their full extent as in my figure of the feet of *D. horribilis*. Also in Boas's figure it may be noted that the pad of the first digit is set farther back, a much greater extent of the heel is covered with hair, and that the transverse groove on the inner half of the sole is larger and invaded by hair. This character, however, is variable in *U. arctos*.

A point of special interest connected with the feet of *Danis horribilis* is their resemblance in the alignment and fusion of the digital pads to the feet of *Melursus ursinus*. In the latter, however, all the digital pads are united to the same, or nearly the same, extent* as are those of the third and fourth digits of the hind foot in *D. horribilis*, and the posterior border of the pads is less well defined and the area between them and the plantar pad is quite naked. Similarly, in the fore foot of *Melursus* the area between the plantar pad and the carpal pad is naked, and above the carpal pad the integument is for a short distance quite scantily clothed with hair. Nevertheless, the structure of the feet of *Melursus* suggests that this genus is a specialized modification of the *Danis*-type rather than of the *Arcticonus thibetanus* or *Helarctos malayanus*-type, the hemispherical ulnar carpal pad and reduced radial carpal pad recalling these structures in *Danis*, *Ursus*, and *Euarctos*.

In *Helarctos malayanus*, as I have already stated from an examination of living specimens and dried skins, the feet resemble tolerably closely those of *Arcticonus thibetanus*. This I have been able to verify on a fresh specimen from British North Borneo. The digital pads are free and susceptible of wide divarication as in *Euarctos*, but when in contact their alignment is not quite so strongly curved as in that genus. The hair clothing the area between the digital and plantar pads is reduced to four patches opposite the interdigital spaces, and these patches are much larger on fore than on the hind feet and the anterior border of the plantar pad is less well defined than in *Euarctos*. In the fore foot the carpal pad forms an area as wide as the plantar pad and continuous with it, as in *Arcticonus thibetanus*, but the divisional line between the two is much less emphasised than in the specimen of that species I figured in 1914. In

* The degree of fusion varies within the genus, the sutural line sometimes being distinctly retained, sometimes almost obliterated as in my original figure.

the hind foot the sole, as in *Arcticonus tibetanus*, but not in *Euarctos*, shows no deep inrunning depression on the hallucal side and the hairy area of the heel is comparatively short as in *Arcticonus*.

The genera above enumerated may be defined by the following combination of external characters:—

GENUS MELURSUS, Meyer.

Rhinarium transversely elongate, without median groove, and not traceable to edge of upper lip, which is smooth beneath the rhinarium, the margin of the latter overlapping the valvular nostrils above and laterally. Lips and tongue long and highly protrusible. Ears large. Feet with fused digital pads and area between these pads and the plantar pad hairless; carpal area of fore feet naked, but with radial pad forming a rounded eminence as in *Ursus*, and ulnar pad also defined, though indistinctly; groove on plantar pad of hind foot deep and moderately long.

Type and only species, *M. ursinus*.

GENUS HELARCTOS, Horsfield.

Rhinarium not transversely elongated, with median groove traceable to lower edge of upper lip, which is smooth beneath the rhinarium, the latter laterally overlapping the septum between the expanded portion of the nostrils. Lips and tongue less protrusible than in *Melursus*, more so than in the succeeding genera (? *Tremarctos*). Ears very small, with supporting ridges, apart from the supratragus, obsolete. Feet with free digital pads and area between them and the plantar pad with four interdigital mats of short hair; carpal area covered by a continuous large pad separated from the plantar pad by a comparatively narrow crease; groove on plantar pad of hind foot short and shallow.

Type, *H. malayanus*. Number of species or subspecies doubtful.

GENUS ARCTICONUS, Pocock.

Rhinarium at least differing from that of *Helarctos* in that the lateral lobes do not overlap the expanded portion of the nostrils, which are thus exposed in profile view. Upper lip less protrusible and hairy beneath the rhinarium up to the median vertical groove. Ears large, expanded, with well-defined ridges. Feet of the same type as in *Helarctos*, but with the groove between the plantar and carpal areas better defined and the hairs of the interdigital mats longer.

Type, *A. tibetanus*. Number of species and subspecies doubtful.

Genus TREMARCTOS, Gervais.

External characters known to me only from dried skins, but apparently resembling those of *Arcticonus*, although the examination of fresh material will probably reveal some differences in the feet and other organs. Pending this the two genera may be distinguished by the skull-characters I pointed out in 1917.

Type, *T. ornatus*. One or two species.

Genus EUARCTOS, Gray.

Rhinarium, lips, and ears apparently essentially as in *Arcticonus*, but the ears smaller. Feet differing from those of *Arcticonus* in that the carpal area is thickly covered with hair, from which the ulnar carpal pad arises as a hemispherical excrescence towards the inner side of the wrist, and the groove on the plantar pad of the hind foot is much deeper, wider, and longer, and filled with hair spreading inwards from the margin of the sole.

Type, *Eu. americanus*. A few species.

Genus URSUS, Linn.

Approximately resembling *Euarctos* in external characters, except that the digital pads are united by membrane in the basal half of their length, although capable of considerable separation. Further distinguishable from *Euarctos* by the cranial features described by Merriam in 1896.

Type, *U. arctos*. Probably a few species, certainly many subspecies.

Genus DANIS, Gray.

In external features agreeing with *Ursus*, but with the pads of the third and fourth digits of the hind foot completely fused in the basal half and inseparable, and all the rest of the digital pads united by much narrower webbing, so that the digits themselves are susceptible of very slight divarication.

Type, *D. horribilis*. Two species, possibly more.

Genus THALARCTOS, Gray.

Rhinarium, lips, and ears, so far as it is permissible to guess, resembling those of *Ursus* and *Euarctos*, and the feet conforming to the same general type as in those genera*, but the soles much more overgrown with hair enormously reducing the size of the plantar pads, the pad behind the plantar pad of the hind foot represented by a small elongated piriform pad towards the inner side of the foot about halfway between the plantar pad and the heel.

Type, *Th. maritimus*. Only one species admitted.

* In newly-born cubs the digital pads are not united.